The earliest evidence of heptatonism in a late Old Babylonian text: CBS 1766

By: Richard J. Dumbrill

Foreword

Early in June 2007, Caroline Waerzeggers and Ronny Siebes[1] from the Vrije Universiteit in Amsterdam proposed an alternative interpretation to a thesis in a paper published by Wayne Horowitz, of the Hebrew University, New York, in the Journal of the Ancient Near Eastern Society[2].

The text under disquisition is at present in the collection of the University Museum, Philadelphia under number CBS 1766. It was published by Hilprecht about one hundred years ago in his *Explorations in*

[1] *N.A.B.U.*, (2007), no.2 (juin), pp. 43-45.
[2] JANES, Vol. 30, 2006

Bible Lands During the 19th Century. This volume included a photograph of the inscribed side with the label: '*Astronomical Tablet from the Temple Library*'.

In Horowitz's words, the designation of the text was untested and has been for the most part forgotten. No edition or even copy of the tablet was ever published, and the only printed study of the text was that of A. Jeremias[3] where a reprint of the photograph is accompanied by a proposal that the text provides an astrological scheme to relate the seven ancient planets to the seven days of the week.

In *HKL* I, Borger describes the tablet as: '*Astronomisch*', following Hilprecht, and lists it in *HKL* III, pp. 114-115 under the category '*Astronomie, Sternlisten, Kalenderwissenschaft*'. C.B.F. Walker included it in his '*Bibliography of Babylonian Astronomy and Astrology*'[4].

Thus the merit of having spotted misreadings of the text, especially with regard the nomenclature of the heptagon, comes to the Dutch

[3]Jeremias, A., *Handbuch der altorientalischen Geisteskultur,* 2nd ed., (Berlin and Liepzig, 1929), pp. 197-199.

[4]CBF Walker, in: GRAZER MORGENLÄNDISCHE STUDIEN 3 *Die Rolle der Astronomie in den Kulturen Mesopotamiens.* Beiträge zum morgenländischer Symposion (23-27 September 1991), herausgegeben von Hannes D. Galter. pp. 407-445.

scholars who spotted musical terms that they had read, previously, in Kilmer's 1965 paper[5], and in other works.

Fig. 1, CBS1766, courtesy of the UM, Philadelphia

[5] *The Strings of musical instruments: their names, numbers and significance'* in *Fs. Landsberger* (=AS 16), 261-268; Dumbrill, R.J., AANE, Trafford, (2005), pp.27-36.

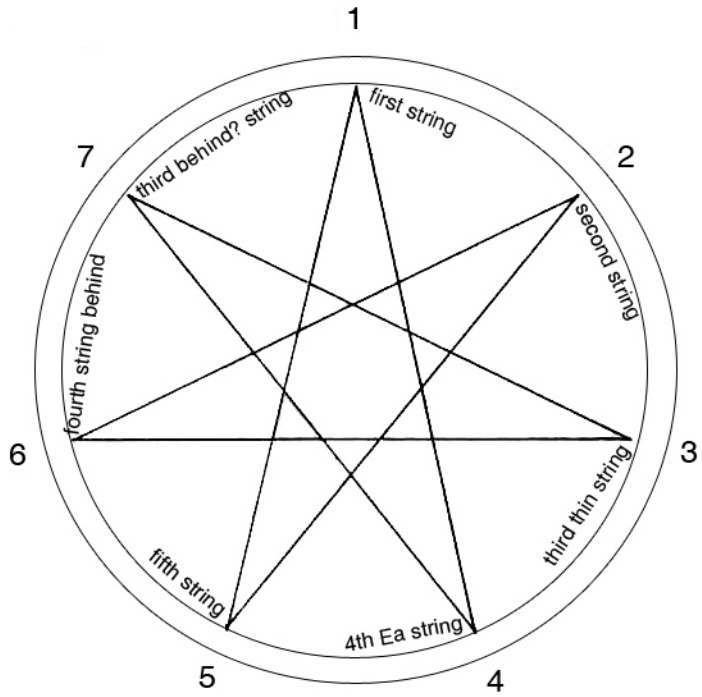
1.0 Description of the text

The tablet is divided in two sections. The first section, at the top left consists of a heptagram[6] with annotations, inscribed within two concentric circles. The second section, below the heptagram, is a table with 11 columns of which the first is empty, with traces. Columns two and three are inscribed with two lists of seven numbers each; column four is empty without any traces; and columns five, six and seven are inscribed with only one line of numbers. A header spreads along the whole length of the columns; column 11 has traces of terms. Many propositions have been put forward regarding the interpretation of the header but none, up to now, is sufficiently safe for any reasonable extrapolation to be made.

The readings of the first two columns to the left of the table and the nomenclature of the heptagram are undisputed and yield, it is contended, the essential of what the text has to offer. However, the present study will

[6]In general, a heptagram is any self-intersecting heptagon, a seven-sided polygon. There are two regular heptagrams: 1) the 7/2 heptagram and 2) the 7/3 heptagram. It is the 7/3 heptagram which is depicted in CBS1766. This is the smallest star polygon that can be drawn in two forms, 7/2 and 7/3, as irreducible fractions.

restrict itself, exclusively, to the heptagram and to the figures in column two.



col. 2	col. 3
2 6	1 7
6 3	5 4
3 7	2 1
7 4	6 5
4 1	3 2
1 5	7 6
5 2	4 3

Fig. 2, CBS1766, undisputed readings

1.1 The heptagram and heptatonism

Any music theoretician presented with a heptagram would conclude, should they be assured that the context is musical, that the figure is a diagrammatic explanation for the formation of the heptatonic diatonic musical scale. They would expect to find numbers, notes, pitches

or degrees on each of the star's points, starting at the top, and then explain that the intersecting lines linking the numbers would describe the alternation of intervals of fifths and fourths which are the basis for the formation of the diatonic heptatonic paradigm. Should they wish to illustrate further the principle, they would draw a table with a series of numbers which would flow in the following sequence: 1-5-2-6-3-7-4-1, as a complementary explanation of how the heptagonal construction works. Should they substitute notes for numbers, as they are displayed on the circumference, clockwise, then the notes could be any ascending or descending series starting on any note of the heptatonic scale: c-d-e-f-g-a, or b.

It is therefore unsurprising that the names and numbers which appear on the heptagon in CBS1766 are precisely what our music theoretician would have written, without hesitation, on a similar pattern. Indeed, the number at the top of the heptagon is 1 and its nomenclature is *qú-ud-mu,* meaning the first string, unsurprisingly. The orthography

diverges from UET VII 126[7], a Late Babylonian copy of the 32nd tablet of the series Nabnitu. There we have Sumerian sa.di with Akkadian equation *qud-mu-u[m.*[8]`The second term, clockwise, is headed with number 2 followed by *sa-mu-šum*, close enough to *sa-mu-šu-um* in the same UET; the term which follows is not readable but it must have been *šal-al-šu qa-at-nu* since this is what follows in our text of reference; then we have *a-ba-nu* rightly followed by *ḫa-an-šu* and *re-bi? úḫ-ri*. The sequence ends with number 7, *šal-šu* [XX]. The last signs resist reading but we would expect something expressing that it was the 'xth behind-string', i.e., the 'xth last string' as we have it in UET VII 126. Now, that the numbers in the table are substituted for the names of the strings on the heptagram is of high significance as this constitutes the first instance in the history of music of a dichotomy between the string itself and the sound it produces. The string is called 'x' but its value is '1', therefore it could also be '2', '3' or whatever number of degrees they had in their scale, in this case, up to degree '7'.

[7]Gurney, O.R., Ur Excavations Texts, VII, Middle Babylonian Legal Documents and other texts, 1974, Pl. LX; Crocker, R.L., and Kilmer, A.D., *The Fragmentary Music Text from Nippur*, IRAQ XLVI, Autumn 1984; Dumbrill, R.J., *opus. Cit.,* pp. 47-70.

[8] Kilmer, A.D., *The Strings of Musical Instruments: Their Names, Numbers, and Significance.* Assyriological Studies 16, (1965), pp. 261-272; Dumbrill, R.J., *opus cit., pp. 27-36*

This tells us that they would have distinguished modal music in the dynamic disposition, from the thetic disposition, as we have it in UET VI, 74[9].

The second column, which includes two descending series of numbers, can be interpreted as follows: Firstly, we may read the first series, from top to bottom as 2-6-3-7-4-1-5, or twin it, in horizontal reading, with the second series: 6-3-7-4-1-5-2 and read it this way: [2-6/6-3] [3-7/7-4][7-4/4-1][1-5/5-2]. In both cases, we end up with the same construction. Thus we may safely assume that the second series is a complementary explanation to the first, although it is impossible to say if this was intentional.

2.0 Theory

It seems appropriate at this point of the present study to profess that music theory only exists for the intellectual entertainment of the music theorist. The music maker has neither time nor need for it. Music theory

[9]Gurney, O.R., *Babylonian Music Again,* IRAQ LVI, (1984) pp. 101-106; Crocker, R.L., Remarks on the Tuning Text UET VII, 74, *Orientalia* 47, (1978), pp.99-104; West, M.L.,The Babylonian Music Notation and the Hurrian Melodic Texts, Music and Letters, 75/4, (1993), pp. 161-179; Vitale, R., La Musique Suméro-Accadienne, Ugarit-Forschungen, (1982), pp. 240-263; Dumbrill, R.J., *opus cit.*, pp.47-69.

is the consequence of metrology and therefore is a concept finding its origins in literate times. Therefore, it must be made clear that heptatonism is an invention of the theorist - an artificial concept the purpose of which being the discovery of some mathematical consistency within a natural medium.

The heptatonic paradigm, as its name suggests, can only include 7 diatonic degrees. Whatever pitch is chosen to start the sequence of alternating fifths and fourths, whether ascending or descending, the system will always end up with the ultimate pitch, the seventh of the sequence, conflicting with the penultimate pitch of the sequence, amounting to the evil sounding tritone, the *diabolus in musica*[10].

This peculiarity of the heptatonic construction is highly significant as it infers that it was the result of sophisticated reasoning which would not have been possible without a basic knowledge of the metrology of ratios. Indeed, in pre-literate times, the alternation of fifths and fourths,

[10]A fifth is made up of 7 semitones, and a fourth of 5 semitones. They amount to 12 semitones which constitute an octave. Therefore the alternation of fifths and fourths in ascending or descending order will end up when it is no longer possible to continue the progression because the seventh note of the progression becomes an interval of 6 semitones, the tritone, which is the most imperfect, the dissonant interval. This is why the heptatonic paradigm has no octave interval.

rising or falling, would not have met the stumbling block of the tritone because they would have corrected it, spontaneously and unconsciously because they were unrestricted, intellectually, by the limitation of the octave. Consequently, this progression would have only been limited to the vocal ambitus rather than by the octavial barrier.

2.1 UET VII 126

Before explaining the reason why the second column starts with number two and not one, as would seem obvious, it is appropriate to introduce UET VII 126, which suggests an arrangement of strings/pitches having found its sources, it is contended, in pre-literate times, devoid of 'theoricitude', and then would have been transcribed in literate times. It would pre-date the heptatonic paradigm. The text lists nine strings: *first string; second string; third-thin-string; fourth-small-string, made/corrected by the god Ea; fifth string; fourth-behind string; third-behind-string; second-behind string* and *behind-string.* The list ends, unequivocally, by the attestation that there are nine strings, no more and no less. Nothing could be clearer. It is also clear that the nomenclature expresses symmetry that we see later in

Greek string nomenclature, although the Greek model is restricted to the heptachord. Two strings, however, have qualificatives: *'third-thin-string'* and *'fourth-small string made/corrected by the god Ea'*. The qualification that the third and fourth strings are smaller, thinner, made, or corrected by a god, would suggest that they are at the treble and not the bass of the register, and that the fourth has a special status because it is associated with a deity. Significantly, the relationship of the first string to the fourth could have been tritonic. The god Ea would have *'corrected it to consonance'*. This seems a reasonable explanation for the qualification of the fourth string, probably originating in the thetical arrangement.

2.2 UET VII 74

The heptatonic system above must be radically segregated from an older model described in UET VII, 74[11], where the generative paradigm comes from an instrument fitted with nine strings, the enneachord, exposing the theory of a nine note system that is called enneatonism.

[11]Gurney, O.R., *opus.cit.;* Kilmer, A.D., The Discovery of an Ancient Mesopotamian Theory of Music, *Proceedings of the American Philosophical Society,* 115 (1971), 131-49; Wulstan, D., The Earliest Musical Notation, *Music and Letters* 52, (1971), 365-86; Duchesne-Guillemin, M., the Hurrian Musical Score from Ugarit; The Discovery of Mesopotamian Music, *Sources from the Ancient Near East (SANE)* 2, fasc. 3 (Malibu 1984). Dumbrill, R.J., *opus cit.*, pp. 47-69.

There, the generative scale is the descending diatonic enneatonic scale of c-b-a-g-f-e-d-c-b, known as *išartum.* Indeed, in the enneatonic construction, the first string of the *sammu*-instrument is note/degree C. Therefore, the construction in CBS1766 could only have started with note/degree 2, which could only have been note B. the reason for this is that the formation of the enneatonic system differs from the heptatonic. The enneatonic model is not constructed by the alternation of fifths and fourths but with a construction based on symmetry, starting from the central note/degree from which pitches rise and fall always symmetrically, and always creating symmetrically equal intervals. This symmetric tuning system is the cause of enneatonism whilst the tuning in alternating fifths and fourths is the cause of heptatonism. As a consequence the enneatonic system has nine notes whilst the heptatonic has seven. Both enneatonic and heptatonic systems use fifths and fourths as fundamental intervals without which neither system could be constructed. However, enneatonism introduces the interval of the third, probably as a relic of the

older pentatonic system which would also have used a symmetrical construction.

2.3 *CBS 10996*

CBS10996[12] has been almost consistently, and erroneously, labelled as a tuning text. Most importantly, the text has the peculiarity of expressing heptatonism because its numeric pattern, unequivocally has a limitation to 7 numbers, and not 9, unlike UET VII 74 and 126. CBS 10996 is a list of intervals where only fifths and thirds, and their reciprocals, fourths and sixths are given, to the exclusion of any other. The text is Neo-Babylonian from the early first millennium whilst CBS1766 is late Old-Babylonian. Since UET VII, 126 is also from the early first millennium and UET VII, 74 is Old-Babylonian, it could be construed that both systems, enneatonic and heptatonic, lived alongside one another and, perhaps, that each was used for specific instruments, fitted with nine and seven strings, respectively.

[12]Dumbrill, R.J., *opus cit.*, pp.37-45.

2.4 MS 5105 in the Schoyen collection[13]

I examined this tablet before it was acquired by the Schoyen Collection, and published it. The text lists numbers up to 14. This is crucially important because it attests of the doubling of the heptatonic model as [1-2-3-4-5-6-7]-[8-9-10-11-12-13-14], clearly 7 + 7, excluding the octave, otherwise there would have been a 15th number, obviously, because had 1 equated to 8 then 8 would have equated to 15, absent in the present series, significantly excluding the concept of the octave. Therefore, the series of numbers expresses the double heptachord and not the double octave as many would be tempted to say. The second series of numbers: 8-9-10-11-12-13-14, would be the replication of 1-2-3-4-5-6-7, at a higher or lower register, and not as an octavial continuation of the series, as we would understand it nowadays. This is the third text attesting of heptatonism. It is also Old-Babylonian.

[13]Dumbrill, R.J., *opus cit.*, pp. 96-110.

3.0 Sexagesimalism and god-numbers[14]

Few scholars have accepted that there is a relationship between music and god numbers. Professor McClain pioneered the concept although I came to the same conclusions, later, prior to my knowledge of his work. It is therefore significant that we both came to the same conclusions although coming from different approaches. Whilst McClain looked for answers, mainly from the mythography, I seeked mine, mainly from textual evidence, and we met right at the middle which is the symmetry of the system. Many scholars have rejected this concept, whether it came from McClain or from myself but it is contended that the reason relied mainly on subjective rather than objective disquisition. The subjective being mainly fuelled by the erroneous premise that all scale non pentatonic must be heptatonic because any other system was inconceivable - until I brought it to the attention of my colleagues.

Essentially the well attested god numbers, which are all sexagesimal integers, equate to the natural fundamental integers in the ratios found in

[14]Dumbrill, R.J., Babylonian Theonumerics and scale systems, JAC 2 (2007); Crickmore, L., A New Hypothesis for the Construction and Tuning of Babylonian Musical Scales, JAC 2, (2002).

Babylonian theoretic texts: 60 for Anu (also 21); 50 for Enlil; 40 for Ea; 30 for Sin; 20 for Šamaš; 10 for Marduk; 14 for Šakkan and Nergal and lastly 6 for A*dad*. However, the essential numbers are 60; 50; 40; 30 and 15. 60:60 is the central note; 60:50 is the minor third; 50:40 is the major third; 60:40 is the fifth. 60:15 is the double octave. Now CBS 10996 lists, precisely, these intervals, to the exclusion of any others. The enneatonic construction reflects these numbers whilst the heptatonic only uses the fifth and the fourth, *i.e.* 40:30 and 30:20.

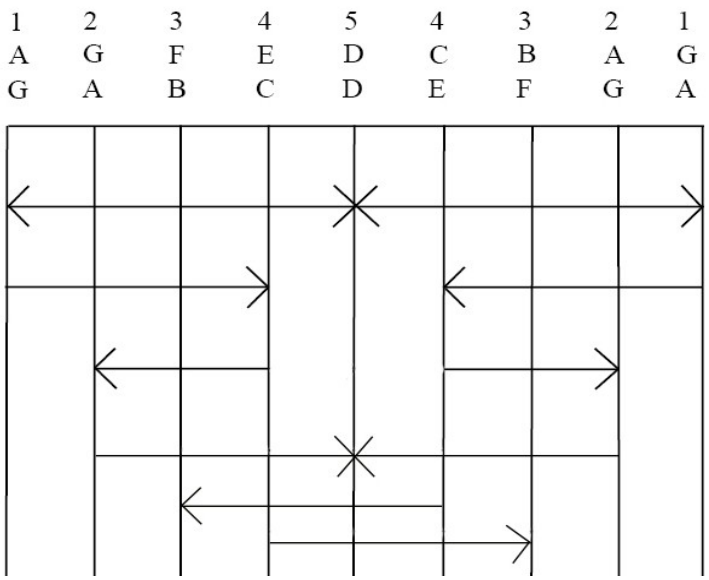


Fig. 2, enneatonic tuning

3.1 *Evidence and Inference within CBS 1766*

Rarely, in the history of cuneiform studies has the relationship between evidence and inference been clearer. With regard the heptagram and the second column, the learned scribe wrote exactly what he meant. His tuning method was still in usage in the 18th century CE, until the equal temperament modified the values of the intervals.

Conclusions

The reading of the header to the table would have certainly enlightened us as to what appears to be numeric inconsistencies, at present, in the other columns. However, the heptagram and the second column, alone, have proved that heptatonism existed some ten centuries before Pythagoras even thought about it. More importantly, it has strongly reinforced my hypothesis of the enneatonic paradigm which would have been the literate transliteration of a pre-literate pentatonic and enneatonic concept. The dating of the texts mentioned attests that probably the three systems, penta, ennea and heptatonism coexisted from

at least the Old-Babylonian to the first millennium, but that with time penta- and enneatonism faded away to the benefit of heptatonism as we still use it, though distorted, to the present day.